

**MTP-322**

# **A SURVEY OF FIVE ON-LINE RETRIEVAL SYSTEMS**

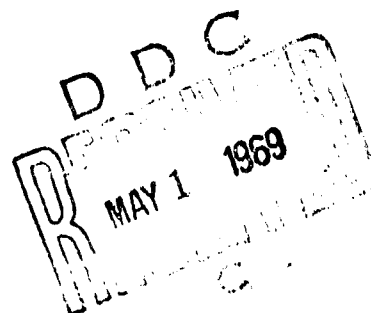
**NOREEN O. WELCH**  
The MITRE Corporation  
1820 Dolley Madison Blvd.  
McLean, Virginia 22101

**AUGUST 1968**  
**FINAL REPORT**

prepared for  
**PANEL 2 OF THE COMMITTEE ON SCIENTIFIC AND TECHNICAL INFORMATION**  
**FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY**  
**WASHINGTON, D.C.**

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# A SURVEY OF FIVE ON-LINE RETRIEVAL SYSTEMS

NOREEN O. WELCH

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The work reported herein was undertaken by the MITRE Corporation in support of Panel 2 of the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology.

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## ABSTRACT

Panel 2 of the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology has inventoried government-sponsored work-in-progress in the area of information sciences and technology. This report is a survey of the capabilities of off-the-shelf interactive data handling systems that could be used to access the COSATI inventory on-line. Described in terms of acceptability, effectiveness, performance, and availability, these systems are Data Corporation's Data Central, Computer Corporation of America's 103, Lockheed Research Corporation's DIALOG, and System Development Corporation's LUCID and TDMS.

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## SECTION I

### INTRODUCTION

This report is a survey of five on-line retrieval systems that, with one exception, have been used to demonstrate on-line access to the recently developed COSATI inventory of government-sponsored work now in progress in the area of information sciences and technology. The systems are described in terms of acceptability, effectiveness, performance, and availability. This report was prepared to assist an ad hoc subgroup of Panel 2 of the Committee on Scientific and Technical Information (COSATI) to determine the state of the art and availability of systems that could provide on-line access to the COSATI inventory. (See Appendix I for a description of the functions of COSATI and of the Federal Council for Science and Technology, of which COSATI is a part.)

The data were obtained by asking the vendor of each system to fill out a questionnaire and add whatever supplementary data he thought relevant. These data were edited and augmented by interviews with the vendors, by hands-on use and benchmark testing of their systems, and by reference to vendor documentation (user's manuals, technical and sales literature, and vendor letters and memos).

The survey is oriented to the needs of on-line access to the COSATI file and no effort was made to develop a comprehensive description of each system. This report does not evaluate the systems.

Section II describes the task background; Section III lists the characteristics of the retrieval systems; and Section IV shows sample outputs.

## SECTION II

### TASK BACKGROUND

#### COSATI INVENTORY

The COSATI Inventory is a compilation of formal short reports of government-sponsored work-in-progress in the area of information sciences and technology. To date, two such inventories have been prepared, the second an enlargement of the first.

The purpose of COSATI Inventory I was to assess the feasibility of creating an interagency data bank. The inventory was undertaken in 1966 and some 1300 records were manually created.

COSATI Inventory II was designed to be used to demonstrate on-line systems. It was completed in 1967. It contains some 2400 records covering five major categories:

- information storage and retrieval
- optical or graphic information processing
- natural language and linguistics
- computers
- computer-aided logical processes

Not every record in the current inventory is complete, but incomplete records are nonetheless included as bases for future work. (Appendix II shows the categories of information sought for each project recorded in the inventory.) Nor is the inventory all-inclusive; many areas of research in the information sciences have evaded inclusion. Work conducted by government laboratories, for instance, is not reported in Inventory II, nor, for that matter, in any other inventory.

The sources of information recorded in Inventory II were:

- submissions from government agencies
- existing data banks, such as those of DDC
- publications of individuals and government agencies responsible for on-going work

#### ON-LINE DEMONSTRATION

In the spring of 1968, COSATI Panel 2 invited six companies to take part in a state-of-the-art demonstration of on-line information retrieval systems. Each company was supplied a set of magnetic tapes containing the COSATI Inventory II. The only guidance provided the participants was that each be prepared to demonstrate the utility of accessing such a data base on-line.

It had been hoped that all these systems could be demonstrated to COSATI Panel 2. During April and May 1968, however, rehearsals showed that "live" demonstrations could not adequately be presented to any but a very small audience. Since there are more than 50 members and observers of COSATI Panel 2, an alternate method of demonstration had to be devised. A set of narrated filmed sequences of the "on-line" systems was prepared by Battelle Memorial Institute in cooperation with the companies, and in June 1968 it was presented to COSATI Panel 2 in conjunction with supplementary "live" demonstrations.

These demonstrations were arranged at no direct cost to the United States Government. Where possible, however, terminals and/or computer time in the Washington area were provided by government agencies.

The selection of companies to participate and systems to consider was determined by two criteria--first, the uniqueness of

their approach to information retrieval and, second, their willingness to perform the experiment. The companies and their respective systems were:

Computer Corporation of America	103
Data Corporation	Data Central
General Electric Corporation	Rapid Search Machine
Lockheed Research Laboratories	DIALOG
Programmatics	TORQUE
System Development Corporation	LUCID-QUUP

Of these six, General Electric and Programmatics withdrew because their systems could not be demonstrated within the time frame established by COSATI Panel 2.

A third inventory is currently being designed and will be implemented sometime during 1968-1969.\* The objectives of the 1968-1969 effort are to:

- demonstrate operational status of a national network of remote terminals
- provide on-line access to COSATI Inventory III
- obtain complete reports on individual projects

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\* C. Bourne of Programming Services Incorporated will be responsible for the acquisition, editing and machine preparation of the 1968-1969 edition of COSATI Inventory III.



### SECTION III

#### SYSTEM PROFILES

System profiles are shown in the following extended table. Appendix V contains lists of the salient features of the four systems which were demonstrated to COSATI Panel 2.

I. ACCEPTABILITY OF SYSTEM (Man/Machine Interface)	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TOMS
A. <u>System Start-Up Procedure</u>					
1. <u>Manual</u> (e.g., data phone to remote site, verbal to computer operator)	YES	YES	YES	NO	NO
2. <u>Automatic</u> (interrupt computer from on-line console)	(1)	YES	NO	YES	YES
B. <u>System Sign-Off Procedure</u>					
1. <u>Manual</u> (e.g., data phone to remote site, verbal to computer operator)	YES	YES	YES	NO	NO
2. <u>Automatic</u> (sign-off signal to system)	YES	YES	NO	YES	YES
3. <u>Console input message to remote computer operator</u>	NO	YES	YES	NO	NO
4. <u>Other</u>		(2)			(4)
C. <u>Equipment</u>					
1. <u>CRT</u>	(1)	IBM 2260	IBM 2260	NO	NO
a. Room must be darkened	NO		NO	NO	NO
b. Output presentation					
(1) all at once		NO	NO	YES	
(2) line-by-line		YES	(3)		
c. Cursor				N/A	
(1) destructive		NO	NO		
(2) non-destructive		YES	YES		
(1) Currently being implemented. (2) Temporary sign-on/off of one remote terminal can be accomplished from the terminal; however, permanent sign-off must be accomplished by the computer operator. (3) 4 sec/remote, 12 sec/local. (4) Device-independent.					
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I.C.1 CRT (continued)	DATA CORP DATA CENTRAL	CCA 103	LOCKHEED DIALOG	SDC	
				LUCID	SDC TDMS
d. Cursor (and consequently input) can be positioned anywhere on the screen		YES	NO		
e. Any display (i.e., contents of CRT screen) can be printed by on-line user		YES	YES	(6)	
(1) typed command (software)					
(a) remote printer		YES	YES		
(b) available printer		NO	YES		
(2) special purpose key (hardware)					
(a) remote printer		NO	NO		
(b) available printer		YES	YES		
f. Size of display					
(1) number of lines		12	12	51	
(2) characters/line		80	80	72	
g. Available character set		ALL	UNIVERSAL	(7)	
2. Teletype	IBM 1050	N/A	N/A	YES	
a. Characters/second	14.8				
b. Typing errors corrected					
(1) backspace	(5)				
(2) erase character	(5)			YES	
(3) delete line/command/query	YES			YES	
(5) Currently being implemented. Date available 10 July 1968. (6) Polaroid or photo only. (7) All letters, digits, and ≈ 15 special symbols.					
					4/30/68

i.C-2 Teletype (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TIMS
c. Noise level		YES			YES	
(1) negligible						
(2) bothersome or distracting						
(3) unbearable						
3. Keyboard						
a. System-reserved keyboard characters not available to the user			NONE	NONE	(11)	
b. Special command keys		(8)	(9)	(10)	(11)	
D. Training						
1. On-line tutorial for the uninitiated user exists		NO	NO	NO	NO	YES
a. Tutorial can be suppressed at any time by user						YES
b. Tutorial can be invoked at any time by user						YES
c. Estimated training time (on-line)			1 HOUR		(12)	
E. Language						
1. On-line command, query composition		YES	YES	YES	YES	YES
2. Batch command, query composition		YES	YES		NO	NO
3. Size restriction of an input						
a. Provision for continuation						
(1) line		YES	YES	YES	YES	YES
(2) card		YES	NO	NO	NO	
(3) record		NO	NO	NO	NO	
(8) \$S = short, \$ as leading character depicts a field name, ' encloses phrases. (9) P = new page, etc.						
(10) Special characters on numeral keys, see Appendix IV. (11) ; and " and * have special meanings.						
(12) 3 hours for programmer, 2 weeks for non-programmer.						
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I.E. Language (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TMS
4. <u>Acronyms for established procedures</u>						
a. User-specified		YES	YES	YES	N/A	YES
b. System-generated		(13)	YES	NO		YES
		NO	NO	YES		NO
5. <u>Distinction between user input/system output</u>		YES	NO	YES	YES	YES
a. Lower/upper case (teletype)		YES		NO	NO	NO
b. Large/small characters (CRT)		N/A		NO	NO	NO
c. Red/black (teletype)		YES		NO	NO	NO
d. Indentation		YES		NO	NO	NO
e. Special character		NO		NO	NO	NO
f. Position on screen or page		NO		YES	NO	NO
g. Other		(14)			(15)	(15)
6. <u>Storage of composed procedures</u>		NO	YES	YES	NO	YES
a. Permanent library			YES	NO		YES
b. Temporary save			NO	YES		NO
7. <u>Storage of results of query</u>			YES	YES	(16)	NO
a. Hold file (temporary)		YES	NO	YES		
b. Permanent hold		NO	YES	NO		
c. These files are available						
(1) for printing		YES	YES	YES		
(2) for additional queries		(17)	YES	YES		
(13) User-specified format numbers.						
(14) Page and field headings.						
(15) Obvious from context.						
(16) Hard copy only.						
(17) Currently being implemented. Estimated date available 15 August 1968.						

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I.E Language (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TDMS
8. <u>Error messages</u>		YES	YES	YES	YES	YES
a. Self-explanatory (text)		YES	YES	YES	YES	YES
b. Code		NO	YES	NO		NO
c. If both text and code, can text be suppressed?		N/A	NO	N/A		
9. <u>Recovery procedure for type or format error</u>		YES	YES	YES	YES	YES
a. Correct a character		NO	YES	YES	YES	YES
b. Correct a line		YES	YES	YES	(21)	YES
c. Entire procedure must be re-entered		(18)	NO	NO	NO	
10. <u>Cancellation or modification of current procedure</u>		NO	YES	YES	NO	YES
a. Refine or modify a previous procedure for reiteration		(17)	NO	YES		NO
b. Cancel or abort an active procedure/output			(19)	YES		YES
11. <u>System automatically limits console on-line output</u>		NO	YES	(20)	(22)	YES
a. If yes, maximum number of lines			10		10	USER SET
b. System limitations can be overridden from console			YES		NO	YES
(17) Currently being implemented. Estimated date available 15 August 1968.						
(18) If user does not detect an error prior to sending it to the system, the user must reinitialize (currently being revised).						
(19) All except for hurry scanning mode.						
(20) Output is segmented and must be successively requested.						
(21) Restart a line.						
(22) Only in one special case; query output is unlimited. User is informed of number of entries which may qualify. User may choose number of lines to output.						

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II. EFFECTIVENESS OF SYSTEM		DATA CORP	CCA	LOCKHEED	SDC	SDC
A. File Definition		DATA CENTRAL	103	DIALOG	LUCID	TDMS
1. Physical Characteristics						(25)
a. Size						
(1) data base						
(a) overhead		100%		8x10 <sup>6</sup> bytes (23)	11-2% of data	
(b) actual data		No max.		370x10 <sup>6</sup> bytes	1x10 <sup>6</sup> values	
(2) file		4 char. + 30 char key dict				
(a) overhead		100%		8x10 <sup>6</sup> bytes (23)		
(b) actual data		No max.		370x10 <sup>6</sup> bytes		
(3) group (periodic or otherwise)		N/A				
(a) overhead				20 bytes		
(b) actual data				2000 bytes (24)		
(c) data element						
(a) overhead		4 char.		4 bytes		
(b) actual data		(24)		100 bytes (24)		
b. Representation						
(1) EBCDIC		YES	YES	YES		YES
(2) ASCII		AVAILABLE	NO	YES		NO
(23) Consists of field identifiers and pointers.						
(24) Variable length.						
(25) Overhead and size of stored data are variable.						

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II.A.1 Physical Characteristics (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TIME
(3) fraction (integer subsumed)						
(a) binary		NO	NO	NO		YES
(b) packed decimal		NO	NO	YES		NO
(c) floating point		FUTURE	NO	NO		YES
(5) other						
(a) Hollerith					YES	
(b) integer					YES	
2. Logical Characteristics						
a. Structure						
(1) inverted		YES	NO	YES	YES	YES
(2) hierarchical		YES	NO	YES	YES	YES
(a) number of levels		1		(28)	1	16
(b) number of periodic groups/level		1				255
(3) other		(26)	(27)			
3. Procedures						
a. Self-defining files (each file contains its definition as well as data)		YES	YES	YES	NO	YES
b. Definition of structure of files						
(1) on-line conversational		NO	YES	YES	YES	YES
(2) batch		YES	YES	NO		YES
(26) Maximum of 63 files/data base.						
(27) Scattered.						
(28) Varies (thesaurus-defined).						

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11.A.3 Procedures (continued)	D'A CORP DATA CENTRAL	CCA 103	LOCKHEED DIALOG	SDC	
				LUCID	TIMS
c. Modification of file structure (empty file)	YES	YES	YES	YES	YES
(1) on-line	NO	YES	NO	YES	YES
(2) batch	YES	YES	YES	NO	NO
d. Map one file into another (non-empty file)	YES	YES	YES	NO	YES
(1) on-line	NO	YES	NO		YES
(2) batch	YES	YES	YES		NO
e. Validation definition		(31)			
(1) min/max	YES	NO	NO	YES	YES
(2) range	YES	NO	NO	NO	YES
(3) legitimate character	YES	YES	YES	YES	YES
(4) sequence checking	YES	NO	YES	NO	NO
(5) other	(29)				
f. Error procedure specification					
(1) validation violation	YES	YES	YES		YES
(2) data read	YES	YES	YES		
(3) data write	YES	YES	YES		
(4) other	(30)				
4. Graphic presentation of file structure					
a. On-line	NO	NO	YES	YES	YES
b. Batch	YES	NO	YES	NO	NO
(29) User-coded edit substructure. (30) User-defined substructure. (31) Only in batch mode.					

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11. EFFECTIVENESS OF SYSTEM (continued)		DATA CORP	CCA	LOCKEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TOMS
<b>B. File Maintenance</b> <b>1. Data</b> <b>a. Input/Output</b> <b>(1) physical devices</b> (a) cards (b) disc (c) tape (d) CRT (e) teletype (f) data cell  <b>(2) source/destination of data</b> (a) CODOL (b) FORTRAN (c) JOVIAL (d) ALCOL (e) P1/1 (f) the retrieval system itself  <b>(3) format of maintenance data</b> (a) described at file-definition time and relatively static (b) described with data (dynamic)						
(32)		Y/N	Y/N	N/N	(INPUT/OUTPUT)	Y/N
		Y/N	Y/N	Y/Y		Y/Y
		Y/N	Y/N	Y/Y		Y/Y
		Y/N	Y/Y	M/Y		N/Y
		Y/N	M/N	M/N		Y/Y
		Y/N	N/N	M/Y		N/N
		(33)			(SOURCE / DESTINATION)	
		Y/N				
		Y/N				
		Y/N				
		Y/N				
		M/N				Y/Y
		YES	YES	YES		NO
		YES	YES	YES		YES

(32) Via format routines written by user, any device is available for both input/output.  
 (33) Any tape interface.

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11.8 File Maintenance (continued)		DATA CORP		CCA		LOCKHEED		SDC	
		DATA CENTRAL		103		DIALOG		LUCID	
2. Maintenance Capabilities									
a. Input processing									
(1) validation criteria									
(a) min/max				NO		NO		YES	
(b) range				NO		NO		YES	
(c) legitimate characters				YES		YES		YES	
(d) sequence checking				NO		YES		NO	
(e) thesaurus of allowable data elements				NO		NO			
(f) other		(34)							
(2) ability to temporarily override previously defined procedures		(35)		YES		YES		NO	
(a) validation criteria				YES		YES			
(b) data definition				NO		YES			
(3) editing		YES		YES		YES		YES	
(a) scan to delete characters				NO		YES		NO	
(b) scan to insert characters				NO		YES		NO	
(c) reformat input fields dependent upon contents of input field				YES		YES		YES	
(d) other		(36)							
(34) User-coded subroutine for editing.									
(35) Only by replacing the existing edit subroutine.									
(36) User-coded subroutine.									

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11.6.2 Maintenance Capabilities (continued)		DATA CORP	CCA	LOCKNEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TIMS
b. Formulation of maintenance functions						
(1) operands						
(a) data elements which satisfy a specified criterion (logical or algebraic)		NO	YES	YES	YES	YES
(b) results of computation		YES	YES	NO	NO	YES
(c) literal		YES	YES	NO	YES	YES
(2) logical operators		N/A				
(a) AND			YES	YES	YES	YES
(b) OR			YES	YES	YES	YES
(c) NOT			YES	YES	NO	YES
(d) other			(37)			
(3) logical comparators		N/A				
(a) EQ (equal)			YES	YES	YES	YES
(b) NE (not equal)			YES	NO	YES	YES
(c) GT (greater than)			NO	NO	YES	YES
(d) LT (less than)			NO	NO	YES	YES
(e) GTE (greater than or equal to)			NO	NO	YES	YES
(f) LTE (less than or equal to)			NO	NO	YES	YES
(4) BETWEEN			NO	NO	NO	YES
(h) CT NOT BLANK			NO	NO	NO	NO
(i) LT NOT BLANK			NO	NO	NO	NO
(37) NON.						

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11.9.2 Maintenance Capabilities (continued)					
	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TDMS
(j) CHARACTER PATTERN		NO	NO	NO	YES
(k) PULSE MATCH		NO	NO	NO	NO
(l) PALS/MIN		NO	NO	NO	NO
(m) EMPTY		NO	NO	NO	YES
(n) other				(38)	(39)
(4) arithmetic operators	N/A			N/A	
(a) = equality		YES	NO		NO
(b) + addition		NO	NO		YES
(c) - subtraction		NO	NO		YES
(d) * multiplication		NO	NO		YES
(e) / division		NO	NO		YES
(f) EXP exponentiation		NO	NO		YES
(g) Log (log base 10)		NO	NO		YES
(h) Ln (log base e)		NO	NO		YES
(5) functions					
(a) AND (insert)	YES	YES	NO	YES	YES
(b) DELETE	YES	YES	NO	YES	YES
(c) MODIFY (replace)	YES	YES	NO	YES	YES
(6) complexity of expressions					
(a) number of operands in a single expression		10 (40)	UNLIMITED	30	UNLIMITED
(b) number of algebraic operators in a single expression	N/A	N/A	NONE		UNLIMITED
(38) Exists, false. (39) Exists. (40) Expandable.					

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II.A.2 Maintenance Capabilities (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TOMS
(c)	order of precedence of algebraic operators		N/A	N/A	N/A	JOVIAL RULES
(d)	nesting of expressions		YES	YES	YES	YES
(e)	depth of nested expressions			UNLIMITED	6	UNLIMITED
(f)	number of logical operators in a single expression		100 (42)	UNLIMITED	4	UNLIMITED
(g)	mixing algebraic and Boolean in a single expression		NO	NO	NO	YES
(h)	number of logical comparators in a single statement		30 (42)	NO	4	UNLIMITED
c. Implementation of maintenance functions						
(1)	storage of user-defined maintenance procedures	YES	YES	NO	NO	YES
(a)	permanent, no. of procedures	99 (41)				YES
(b)	temporary, no. of procedures	99 (41)				YES
(2)	modification of stored user/system-defined maintenance procedures	NO	YES	NO	NO	YES
(a)	permanent modification		YES			YES
(b)	temporary modification		YES			YES
(3)	specification of maintenance functions as macros of already defined functions					
(a)	retrieval statements (number)		YES			YES
(b)	arithmetic statements (number)		MANY			
(c)	logical statements (number)		N/A			
(41) The total number of permanent and temporary procedures is not to exceed 99.						
(42) Expandable.						

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II.B.2 Maintenance Capabilities (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TDMS
(4) intersperse maintenance with other functions, such as reporting		(43)	YES	NO	YES	YES
3. <u>Output Determination</u>						
a. File manipulation						
(1) merging		YES	YES	YES		YES
(2) maximum number of files merged		63		UNLIMITED	2	
(3) sorting		NO	NO	NO	YES	YES
(4) reordering		NO	NO	NO	NO	YES
(5) spreading		NO	NO	NO	NO	YES
(6) subsetting		YES	NO	YES	YES	YES
b. Reporting of maintenance carried out (status reporting)		YES	(44)	NO	YES	YES
(1) accomplished maintenance		YES	YES		YES	YES
(2) error reporting		YES	YES		YES	YES
(3) statistical reporting on changes made		NO	YES		YES	NO
C. <u>Retrieval</u>						
1. <u>Formulation of Queries</u>						
a. Operands						
(1) data elements which satisfy a specified criterion (logical or algebraic)		(45)	YES	YES	YES	YES
(2) results of computation		NO	NO	YES	NO	YES
(43) Can be accomplished by inclusion in user-coded format subroutine.						
(44) User-specified.						
(45) Logical criteria can be "words" in the data element (not limited to complete data-element description). Logical also includes capability to search for the occurrence of specified terms within a given distance of one other.						

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II.C.1 Formulation of Queries (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TIMS
(3) literal		YES	YES	YES	YES	YES
(4) other		(46)				
b. Logical operators						
(1) AND		YES	YES	YES	YES	YES
(2) OR		YES	YES	YES	YES	YES
(3) NOT		YES (47)	YES	YES	NO	YES
(4) other			(48)			
c. Logical comparators						
(1) EQ (equal)		YES	YES	YES	YES	YES
(2) NE (not equal)		YES	YES	NO	YES	YES
(3) GT (greater than)		YES	NO	NO	YES	YES
(4) LT (less than)		YES	NO	NO	YES	YES
(5) GTE (greater than or equal to)		YES	NO	NO	YES	YES
(6) LTE (less than or equal to)		YES	NO	NO	YES	YES
(7) BETWEEN		YES	NO	NO	NO	YES
(8) GT NOT BLANK		NO	NO	NO	NO	YES
(9) LT NOT BLANK		NO	NO	NO	NO	YES
(10) CHARACTER PATTERN		YES (49)	NO	NO	NO	YES
(11) MASK MATCH		YES	NO	NO	NO	NO
(12) MAX/MIN		YES	NO	NO	NO	NO
(13) EMPTY		NO	NO	NO	NO	YES
(14) other					(50)	(51)
(46) Operands may be phrases. (47) In conjunction with other operators. (48) NO. (49) Universal character.						
(50) Exists, fails. (51) Exists.						
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II.C.1 Formulation of Queries (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TDM'S
d. Arithmetic operators		N/A		N/A		
(1) = equality			YES		NO	NO
(2) + addition			NO		NO	YES
(3) - subtraction			NO		NO	YES
(4) * multiplication			NO		NO	YES
(5) / division			NO		NO	YES
(6) EXP Exponentiation			NO		NO	YES
(7) Log (log base 10)			NO		NO	NO
(8) Ln (log base e)			NO		NO	YES
(9) other					(53)	
e. Complexity of expressions						
(1) number of operands in a single expression		UNLIMITED	30 (52)	UNLIMITED	30	UNLIMITED
(2) number of algebraic operators in a single expression		UNLIMITED	N/A	N/A		UNLIMITED
(3) order of precedence of algebraic operators		(54)	N/A	N/A		
(4) nesting of expressions		(54A)	YES	YES	YES	YES
(5) depth of nested expressions				UNLIMITED	6	UNLIMITED
(52) Expandable. (53) SUM, COUNT, AVERAGE, MEDIAN, MINIMUM, MAXIMUM. (54) EQU (NEQ), AEQU, GTR, LSS, NGT, NLT. (54A) Nesting is by use of 2 "AND" operators to wit: A and B or C = A and (B or C) A & B or C = (A and B) or C						4/30/68

11.C.1 Formulation of Queries (continued)	DATA CORP	CCA	LOCKREED		SDC	
	DATA CENTRAL	103	DIALOG	LUCID	SDC	TIMS
'6) number of logical operators in a single expression	UNLIMITED	100 (56)	UNLIMITED	4-5	UNLIMITED	
(7) mixing algebraic and Boolean in a single expression	YES	NO	N/A	NO	YES	
(8) number of logical comparators in a single statement	UNLIMITED	30 (56)	N/A	4-5	UNLIMITED	
(9) other	(55)					
2. <u>Implementation of Queries</u>						
a. Storage of User-defined queries	NO	YES	YES	NO	YES	
(1) permanent - number of queries			UNLIMITED			
(2) temporary - number of queries			UNLIMITED			
b. Modification of stored maintenance procedures	NO	YES	NO	NO	YES	
(1) permanent modification		YES			YES	
(2) temporary modification		YES			YES	
c. Specification of retrieval functions as macros of already defined functions		YES			YES	
(1) retrieval statements (number)	NO	YES	YES	NO	YES	
(2) arithmetic statements (number)		MANY	UNLIMITED			
(3) logical statements (number)		N/A	N/A			
d. Use of items retrieved as input to formulation of further query	YES	YES	YES	YES	YES	
(55) Maximum of 1000 characters in a single statement (core-size dependent).						
(56) Expandable.						

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11.C.2 Implementation of Queries (continued)	DATA CORP DATA CENTRAL	CCA 103	LOCKHEED DIALOG	SDC LUCID	SDC TOMS
e. Standard functions (e.g., square root)	NO	NO	YES		(57)
f. Inclusion of additional user-defined functions	NO	NO	NO		NO
g. Designation of mode of computation	NO	N/A	N/A		NO
h. Statistics	YES		(58)		
D. Access Techniques					
1. Organization					
a. Inverted	YES	NO	YES	YES	YES
(1) all fields/values	YES		YES	YES	YES
(2) designated keywords	YES		YES		
(a) maximum number of fields	UNLIMITED		UNLIMITED		
(3) selected field contents	YES		YES		YES
(a) maximum number of fields	UNLIMITED		UNLIMITED		
(b) range of size of fields	UNLIMITED		50 bytes		
(c) alpha	YES		YES	YES	YES
(d) numeric	YES		YES	YES	YES
(4) text minus thesaurus of excluded terms	YES		NO		
(a) preserve order within sentence	YES				
(b) preserve order of sentence in text	YES				
(57) MIN, MAX, AVG, SUM, SIGMA, COUNT, SQRT, ABS, INT, SIN, COS, TAN, ARCSIN, ARCCOS, ARCTAN. (58) Timing data, command usage.					

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II.D.1 Organization (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUCID	TDMS
b. Hash coding		NO	YES	NO		NO
(1) all fields/values			YES			
(2) designated keywords			NO			
(3) selected field contents			YES			
(a) maximum number of fields/doc			400			
(b) range of size of fields			0-255 char.			
(c) alpha			YES			
(d) numeric			NO			
(4) text minus thesaurus of excluded terms			NO			
c. Sequential		NO	NO			
E. Output Presentation						
1. <u>Conversational Responses</u>						
a. System standard		(59)	YES	YES	YES	YES
(SYSTEM SUPPLIED / USER SPECIFIED)						
2. <u>Report Formatting</u>						
a. Horizontal spacing		Y/Y	Y/Y	Y/N	N/Y	Y/Y
b. Vertical spacing		Y/Y	Y/Y	N/N	N/Y	Y/Y
c. Editing						
(1) zero suppress		N/Y	N/Y	Y/N		Y/Y
(2) algebraic signs		N/Y	N/N	N/N		Y/Y
(3) dollar sign		N/Y	N/N	N/N		N/Y
(4) punctuation		N/Y	N/Y	N/N		N/Y
(59) Any user capability exists via user-coded format subroutine.						

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II.E.2 Report Formatting (continued)					
DATA CORP		CCA	LOCKHEED	SDC	SDC
DATA CENTRAL		103	DIALOG	LUCID	TDMS
(SYSTEM SUPPLIED / USER SPECIFIED)					
d. Computation					
(1) sums/totals	N/Y	N/N	N/N	N/Y	N/Y
(2) counts/tallies	N/Y	N/Y	N/N	N/Y	N/Y
(3) cross footing	N/Y	N/N	N/N	N/N	N/N
e. Titling					
(1) date	N/Y	N/N	Y/N	N/N	N/Y
(2) column headings	Y/Y	N/Y	N/N	N/Y	N/Y
(3) line headings	Y/Y	N/Y	N/N	N/N	N/Y
(4) classification	N/Y	N/N	N/N	N/N	N/Y
(5) page title	Y/Y	N/N	N/N	(60)	N/Y
3. Media					
a. On-line					
(1) typewriter	N/N	N/N	Y/N	N/N	N/Y
(2) CRT	(61)	Y/N	Y/N	N/Y	N/Y
(3) teletype	Y/Y	N/N	N/N	N/Y	N/Y
(4) printer		N/Y	Y/N		
b. Off-line					
(1) tape		N/Y	Y/N	N/Y	N/Y
(2) disc		N/N	Y/N	N/N	N/Y
(3) high-speed printer		N/Y	Y/N	N/N	N/Y
(4) card punch		N/N	Y/N	N/N	N/Y
(60) On delayed output only. (61) Being implemented.					4/30/68

III. PERFORMANCE	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TDMS
A. <u>Timing</u> (approximate)					
1. <u>System start-up</u>	90 sec	20 sec	60 sec		
2. <u>System shut-down</u>	0	5 sec	60 sec		
3. <u>Acknowledge user input</u>		YES	YES	YES	YES
a. Average time to acknowledge					
4. <u>System response to user entry</u> (dead time)	500 ms-8 sec	0.1 sec	0.5 sec	2 sec	SECONDS
a. Maximum time allowed without user input	NCNE	N/A	UNLIMITED	UNLIMITED	NO
b. Average time for error processing	500 ms	0.2 sec	1 sec	2 sec	
c. Average time for valid statement	500 ms-8 sec	0.2 sec	1 sec	2 sec	
d. Elapsed time for response presentation	500 ms		5-15 sec	2 sec up	
B. <u>Benchmarks</u> (see Appendix III for actual commands typed)					
1. Find all instances where keyword is <u>time-sharing</u> (count/time) (63A)		/1.5 sec	2/2 sec		
a. Print out titles for all hits		0.1 sec/line	2 sec/on-line 30 sec/ off-line		
b. Print out all information in data base for each hit					
(1) time/document		4 sec	(62)		
(2) system limits output	NO	YES	NO (63)	NO	YES
(3) user can override system limit	N/A	YES	YES	N/A	YES
(62) ID numbers 10 sec for all 18, full text 30 sec/item. (63) Output is incremental and must be respecified if on-line. (63A) Number of hits found in data base/time to retrieve.					

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111.B Benchmarks (continued)		DATA CORP	CCA	LOCKHEED	SDC	SDC
		DATA CENTRAL	103	DIALOG	LUDIC	TDMS
<p>2. Find all instances where date of report is between March 1967 and June 1967 (count/time)</p> <p>3. Find all instances of (count/time)</p> <p>    Date of Report      March 1967     and A Date of Report      June 1967     and B Keyword      = Factor Analysis     or C Keyword      = Positrons     or D Contract/Grant No.      = GN 10746     and E COSATI Subject Category List     = 009700 Mathematics and Statistics</p> <p>    B+C+D      count/time     A* (B+C+D)      count/time     A* (B+C+D) *E      count/time</p>		/2 sec		256/20 sec		
<p>C. <u>Relevance of System Responses</u></p> <p>1. <u>Standards (system software) for acceptance of a hit</u></p> <p>    a. Satisfy all conditions in query</p> <p>    b. Satisfy minimum number of conditions in query</p>		YES		YES		
<p>D. <u>Error/Abort Procedures</u></p> <p>1. <u>Input error detection</u></p> <p>    a. Syntax error (e.g., illegal conditional)</p> <p>    b. Name designation (e.g., non-existent file, field, etc.)</p>		YES	YES	YES	YES	YES
(66) Unless specified.		YES	N/A	YES	YES	YES

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III.D Error/Abort Procedures (continued)	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TDMS
2. <u>Input error correction</u>					
a. Entire procedure aborted by IR system -- i.e., user must start over again	(65)	NO	NO		NO
b. Current statement re-requested by IR system	(65)	YES	YES	YES	YES
c. Erroneous portion of current statement re-requested by IR system	(65)	NO		YES	YES
d. User abort of current statement (tech- nically correct but user determines it wrong for his purposes)	YES	YES	NO		YES
E. <u>IR System Operating System Interface</u>					
1. <u>IR system degradation</u>					
a. Operating system reaction					
(1) job restarted	YES		YES		
(2) job aborted	NO				
(3) user informed of situation and requested to give further direction	YES		YES		
b. IR system reaction					
(1) self-correcting	YES		YES		
(a) procedure restarted	YES		(66)		
(b) job restarted	NO		YES (67)		
(2) error sensing procedures	NO				
(65) Being modified; available 15 July 1968. (66) In some cases. (67) At user option.					

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III.F IR System Operating System Interface (continued)					
	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TDMS
2. <u>Accounting techniques</u>					
a. Ability to time procedures					
(1) I/O	(68)	YES	YES		
(2) queries		YES	YES		
(3) function		YES	YES		
b. Sensing I/O conditions					
(1) not yet complete	YES	(69)	YES		
(2) errors	YES		YES		
c. Invoke operating system functions					
(1) scan library for required program(s), load into memory and then execute	YES	YES	YES		YES
(2) release machine (multi-programming or time-shared) based upon IR system status	NO	NO	NO		YES
(3) print messages to operator	YES	YES	YES		YES
(4) cause diagnostic aids to be executed	YES	NO	YES		YES
(5) request additional storage	NO	NO	NO		YES
(a) temporary					YES
(b) permanent					YES
(68) Console time-on being implemented 15 July 1968. (69) Automatic.					

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	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TDMS
IV. AVAILABILITY					
A. <u>When Will System Be Operational and Available For Purchase/Rental?</u>					
B. <u>System Can Handle</u>					
1. <u>Remote terminals</u>	YES	YES	YES		
2. <u>Local terminals</u>	YES	YES	YES		
C. <u>Total Number of Active Terminals Which System Can Simultaneously Support</u>	1 (70)	8	5-10 CRT 20-30 typewr		
D. <u>Total Number of Terminals Which Can Be Tied Into the System</u>	(71)		NO LIMIT		
E. <u>If the System is "Remote Rental," What Hours Will the System Be Available?</u>	FLEXIBLE	(72)	NEGOTIABLE		
1. <u>Location of system</u>	Wash. D.C.				
F. <u>What is the Basic Configuration?</u>	360/40 C	IBM 360			
1. <u>Are any special hardware modifications or non-standard hardware required</u>	NONE	IBM 2260/ CCI-CRT			
2. <u>Which operating system does the system run under?</u>	DOS/OS	DOS	DOS (73)		
V. FLEXIBILITY					
A. <u>Modularity</u>					
1. <u>Can additional software modules be added to the system for:</u>		(74)			
a. <u>Intermediate processing of console</u>	YES		YES		
b. <u>Intermediate processing of retrieval data</u>	YES		YES		
(70) June 1968, 1 ≤ N ≤ 35.	(71) Hardware-dependent.	(72) Under consideration.			
(73) OS summer 1968.	(74) Under contract to CCA only.				

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V.A.1 Can additional software modules be added to the system (continued)	DATA CORP	CCA	LOCKHEED	SDC	SDC
	DATA CENTRAL	103	DIALOG	LUCID	TOMS
c. Intermediate processing of maintenance data	YES		YES		
d. Report generation	YES		YES		
B. <u>Modification</u>		(75)			
1. <u>Can the system be changed to include:</u>					
a. Software to support additional different remote (local) terminals	YES		YES		
b. User-designated function subroutines	YES		YES		
C. <u>Documentation</u>					
1. <u>Check available:</u>					
a. Operator's manual	X				
b. User's manual	X	X	X		
c. Maintenance manual					
d. System overview	X	X	X		
e. System design specification	X				
f. Programming design specification					
g. Flow charts					
(1) system					
(2) program	X				
h. Individual program (subroutine) specs					
(75) Under contract to CCA only.					

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## SECTION IV

### SYSTEM OUTPUTS

What follows with explanatory comments are samples of actual man/machine dialogues and printouts using DATA CENTRAL, LUCID, 103, and DIALOG II. (TDMS was not demonstrated.)

#### DATA CENTRAL ON-LINE OUTPUT (DATA CORPORATION)

0	ENTER FORMAT,FILE,OUTPUT DEVICE	System
1	4,WKI\$\$	User
2	ENTER FORMAT,FILE,OUTPUT DEVICE	System
3	4,WKUN,CONSOLE	User
4	--ENTER REQUEST	System
5	\$ANY EQU :INFORMATION THEORY: AND :FORT DETRICK MARYLAND:	User
6	THERE ARE 0001 DOCUMENTS THAT SATISFY YOUR REQUEST.	System
7	DO YOU WANT TO PRINT THESE ANSWERS? - YES OR NO.	System

0	The system must know these three things before proceeding.
1	User error, not possible to backspace, \$\$ aborts procedure.
2	System requests initializing information.
3	User-entered initializing information.
4	System has accepted user input and is requesting further input.
5	User-formulated query. In any field in every resume, whenever the following phrases occur, there is a hit.

INFORMATION THEORY

FORT DETRICK MARYLAND

6, 7 System response to query.

0	ENTER FORMAT, FILE, OUTPUT DEVICE	System
1	99, WKUN, CONSOLE	User
2	ENTER TYPES TO BE DISPLAYED IN ANSWERS	System
3	ACCESSION, RESDATE, TITLE, KEYWORD	User
4	ENTER REQUEST	System
5	\$ANY EQU :INFORMATION THEORY: AND :FORT DETRICK MARYLAND:	User
6	THERE ARE 0001 DOCUMENTS THAT SATISFY YOUR REQUEST.	System
7	DO YOU WANT TO PRINT THESE ANSWERS? - YES OR NO.	System
8	YES	User
9	SET PAPER TO PRINT ON PAGE BREAK PRESS SPACE BAR TWICE AND CARRIAGE RETURN.	System

0	The system must know these three things before proceeding.
1	User-entered initializing information. Format No. = 99 signals the system that the user wishes to designate the fields within each record which are to be printed.
2	System requests fields to be printed.
3	User enters fields to be printed.
4	System requests further input.
5	User query.
6, 7	System response.
8	User reply.
9	System response.

The following printout resulted from the foregoing dialogue:

#### TECHNICAL PROGRAM LISTING

RC 000041

AGENCY ACCESSION#  
DAOA8164

DATE OF RESUME#  
10/09/65

TITLE#  
[U] DISSEMINATION OF LIBRARY OPERATIONAL INFORMATION

KEYWORDS USED#  
[U] DISSEMINATION, [U] INFORMATION, [U] LIBRARY PERFORMANCE,

QUUP ON-LINE OUTPUT (SYSTEM DEVELOPMENT CORPORATION)

USERS ----- (asking system for number of time-share users now  
!USERS on machine)

\$17 USERS.  
LOGIN Im004 Q0507  
\$OK LOG ON 35 07:29.4 04/11/68  
GLOAD QUUP  
\$ NO LOAD DRUMS FULL  
LOAD QUUP  
\$LOAD 35  
GO

\$MSG IN.  
IDENTIFY INPUT DATA BASE.  
LOUSE COSATI I  
INPUT DEVICE ERROR.  
IDENTIFY INPUT DATA BASE.  
USE COSATI  
INPUT DEVICE ERROR.  
IDENTIFY INPUT DATA BASE.  
USE TAPE 1304  
INPUT DEVICE ERROR.  
IDENTIFY INPUT DATA BASE.  
USE COSATI TAPE 1304  
\$ WAIT

\$FILE DBINPT DRIVE 16 REEL 1304  
INPUT DATA BASE NAME IS DDC FORM 1498  
USE IT? YES/NO Y  
!STATUS

\$BTCH QUEUE POSN 6

FROM 09& IF U WISH TO CONT. AT 11:00 PLS GIVE 'STOP' in 10 MINS.

(This command is due to the fact that at 11:00 time-sharing is over  
and, if you wish to save status at that time, you must instruct the  
computer to do so.)

100 PERCENT OF INPUT ON DISC.

(System start-up required  
to get data base loaded  
from tape to disc.)

\* (This is a sample of  
input error processing.)

NEXT?

RETAIN COSATI3

\$ ?

RETAIN COSAT3

\$ ?

"RETAIN COSATI3

DATA BASE ON DISC.

(Will cause data base to remain on disc for two hours. This was done so that loading could be avoided during actual demonstration by SDC later the same day.)

NEXT?

SHOW KEYWORDS ----- (displays keyword phrases and system-assigned synonyms)

-----

V1 (ABSTRACTING AND INDEXING)  
V2 (ACCLIMATIZATION)  
V3 (ACOUSTICS)  
V4 (ACOUSTIC ANALYSIS OF SPEECH)  
V5 (ACQUISITION)  
V6 (ADVANCED ABSTRACTS)  
V7 (AERIAL PHOTOGRAPHS)  
V8 (AIRCRAFT ARMOR)  
V9 (AIRCRAFT ARMOR MATERIALS)  
V10 (ALGEBRA)

420 MORE VALUES

HOW MANY MORE LINES BEFORE NEXT STOP 0

The following queries and system responses are typical:

NEXT?

BLOCK E1 to 9 E47 to 59

NEXT?

PRINT E1 E47 Where E45 EQ V10

-----

1 ENTRY MAY QUALIFY

HOW MANY ENTRIES BEFORE FIRST STOP? 2

AGENCY TECH OBJECTIVE  
ACCESSION  
NUMBER

DAOA6510 TECH OBJECTIVE - A METHOD OF ENCODING PLANAR GRAPHS WHICH IS MINIMAL IN LENGTH HAS PREVIOUSLY BEEN DESCRIBED BY LIST CODING AS IDEAL FROM A COMPUTER POINT OF VIEW. IT IS NOT RECOGNIZABLE TO A CHEMIST. THE TECHNICAL OBJECTIVE OF THIS WORK IS TO DEVELOP A MECHANISM FOR DECODING THIS COMPUTER NOTATION.

NEXT?

E28"

PRINT E28 E31 WHERE SAME - (Use most recent qualifying conditional defined by user.)

----

1 ENTRY MAY QUALIFY

HOW MANY ENTRIES BEFORE FIRST STOP? 2

GOV'T LAB LOCATION RESPONSIBLE  
INDIVIDUAL

ARMY MED R&D COMMAND TIGERTT, W D  
WASHINGTON, D.C. 20\* 202 576-3551  
5

NEXT?

PRINT E24 E25 E26 E27 WHERE SAME

----



FROM 09& IF U WISH TO CONT. AT 11:00 PLS GIVE 'STOP' NOW.

1 ENTRY MAY QUALIFY

HOW MANY ENTRIES BEFORE FIRST STOP? 2

CONTRACT AMOUNT	FISCAL YEAR	PROFESSIONAL YEARS	FUNDS
13200	64	0	0
	65	0	0
	66	0	7
	67	0	0
	68	0	0

NEXT?

PRINT ENTRY FOR 1 (Ran out of time (11:03 a.m.) and lost computer)

103 (COMPUTER CORPORATION OF AMERICA

```

user {
  BEGIN
  1. FIND ALL ITEMS FOR WHICH
    DESCRIPTOR = TIME SHARING OR TIME-SHARING
  2. COUNT ITEMS IN 1
  3. PRINT COUNT IN 2
  END
system 12

```

(The user formulates his request as a series of subrequests.  
The length of the request is theoretically unlimited--that is,  
a request is everything between a given begin-end pair.)

```

user {
  BEGIN
  1. FD
    GOVERNMENT ORGANIZATION = OFFICE OF EDUCATION
  2. FOR EACH ITEM IN 1
    PRINT ALL INFORMATION
  END
  AGENCY CITY = H
  SERIAL NUMBER = 000141
  REPORT DAY = 1
  REPORT MONTH = APRIL
  REPORT YEAR = 66
  KIND OF REPORT = A
  TITLE = THE CREATIVE APPLICATION OF TECHNOLOGY TO EDUCATION /CATE/
  SCIENTIFIC AREA = PERSONNEL SELECTION TRAINING AND EVALUATION
  SCIENTIFIC AREA CODE = 012500
  PRIORIFICATION METHOD = A
  CONTRACT NUMBER = CE-66-1662
  FISCAL YEAR 1 = 64
  FISCAL YEAR 2 = 65
  FISCAL YEAR 3 = 66
  FISCAL YEAR 4 = 67
  FUNDS 4 = 001112
  FISCAL YEAR 5 = 68
system {
  GOVERNMENT ORGANIZATION = OFFICE OF EDUCATION
  GOVERNMENT ADDRESS = WASHINGTON, D. C.
  PERFORMING ORGANIZATION = TEXAS A & M UNIV. & M CONSOLIDATED INDEPENDENT SCHOOL DISTRICT
  PERFORMING ADDRESS = COLLEGE STATION, TEXAS
  PRINCIPAL INVESTIGATOR = MURERT, F
  PRINCIPAL INVESTIGATOR TEL. NO. = 713-846-7736
  OBJECTIVE 1 = A DETAILED PLAN FOR THE DESIGN OF A CENTER FOR THE C.A.T.-E. WILL BE PREPARED, AWARENESS OF THE AVAILABILITY OF NEW TECHNOLOGIES - WILL BE CREATED. FURTHER INFORMATION- DR. FRANK MURERT, UFAN, COLLEGE OF LIBERAL ARTS, TEXAS A & M UNIVERSITY, COLLEGE STATION
  OBJECTIVE 2 = A, TEXAS. 713/ 846-7734.
  CATEGORY CODE = 1C
  DESCRIPTOR = CREATIVITY
  DESCRIPTOR = EDUCATION
  DESCRIPTOR = ADVANCED PLANNING
  DESCRIPTOR = EXPERIMENTAL DESIGN
  DESCRIPTOR = SYSTEMS ENGINEERING
  DESCRIPTOR = MANAGEMENT PLANNING
  DESCRIPTOR = TECHNICAL INFORMATION CENTER
  IDENTIFIER = CATE

```

(FD is equivalent to FIND ALL ITEMS FOR WHICH.)

```

user { BEGIN
      1. FIND ALL ITEMS FOR WHI
        DESCRIPTOR= TIME SHARING OR TIME-SHARING
      2. INCLUDE SEGMENT 1
      END

system { TITLE UNIVERSITY COMPUTER RESEARCH CENTER
          PERFORMING ORG. SYRACUSE UNIV. RESEARCH INSTITUTE
          GOVERNMENT ORG. RADC /EM110/
          CONTRACT NUMBER AF30/602/4283
          INVESTIGATOR STABLER, E. P.
          AGENCY CODE DF576127 CATEGORY CODE 10

          TITLE TEACHING MATHEMATICS THROUGH THE USE OF A TIME SHARED C-
          OMPUTER
          PERFORMING ORG. MASSACHUSETTS STATE DEPARTMENT OF EDUCATION
          GOVERNMENT ORG. OFFICE OF EDUCATION, BUREAU OF RESEARCH, DIVISION OF-
          ELEMENTARY AND SECONDARY RESEARCH, CURRICULUM AND DEMONSTRATION BRANCH

          CONTRACT NUMBER LEC-5-100320
          INVESTIGATOR RICHARDSON, J D
          AGENCY CODE H000010 CATEGORY CODE 50

          TITLE BIOMEDICAL COMPUTING SECTION
          PERFORMING ORG. SCHOOL OF MEDICINE, NEW YORK UNIVERSITY
          GOVERNMENT ORG. DEPT. OF HEALTH, EDUCATION AND WELFARE, PUBLIC HEALTH-
          M SERVICE
          CONTRACT NUMBER
          INVESTIGATOR WORTIS, S B
          AGENCY CODE H000167 CATEGORY CODE 40

          TITLE HOSPITAL COMPUTER PROJECT
          PERFORMING ORG. MASSACHUSETTS GENERAL HOSPITAL
          GOVERNMENT ORG. DEPT. OF HEALTH, EDUCATION AND WELFARE, PUBLIC HEALTH-
          M SERVICE
          CONTRACT NUMBER
          INVESTIGATOR PARNETT, G D
          AGENCY CODE H000171 CATEGORY CODE 40

          TITLE DEMONSTRATION OF A SHARED HOSPITAL INFORMATION SYSTEM
          PERFORMING ORG. THE SISTERS OF THE THIRD ORDER OF ST. FRANCIS
          GOVERNMENT ORG. DEPT. OF HEALTH, EDUCATION AND WELFARE, PUBLIC HEALTH-
          M SERVICE
          CONTRACT NUMBER TCK 4467-1
          INVESTIGATOR PIPER, D D
          AGENCY CODE H000482 CATEGORY CODE 4A

          TITLE APPLICATION OF COMPUTERS IN MEDICAL RESEARCH
          PERFORMING ORG. UNIV. OF ROCHESTER SCHOOL OF MEDICINE AND DENTISTRY
          GOVERNMENT ORG. DEPT. OF HEALTH EDUCATION AND WELFARE PUBLIC HEALTH -
          SERVICE
          CONTRACT NUMBER FR-00220-3/4
          INVESTIGATOR GOLDSIEIN N. A.
          AGENCY CODE H000708 CATEGORY CODE 40

```

(SEGMENT 1 was defined and saved on-line prior to this run.  
It is a formatting routine.)

DIALOG II (LOCKHEED RESEARCH LABORATORY

SEARCH TITLE: PATTERN RECOGNITION

DATE: 04/29/68

REQUESTOR: LARRY STEVENS, SCIENTIFIC AND TECHNICAL INFORMATION DIVISION

(User sign-on procedure.)

COMMAND-OPERAND(S)	SET NO.	IN SET	DESCRIPTION OF SET (*OR, *AND, --NOT)
E-IT/PATTERN RECOGN			

(User wishes to search the thesaurus for PATTERN RECOGNITION but only enters part of the phrase as shown.)

REF	DESCRIPTOR	CITATIONS	REL.	TERMS	REF
E1	IT/PATIENT INFORMATION	1			E1
E2	IT/PATIENTS	15		2	E2
E3	IT/PATENTS	1			E3
E4	IT/PATTERN	31		7	E4
E5	*IT/PATTERN RECOGNITION	113		5	E5
E6	IT/PATTERN RECOGNITION HARDWARE	2			E6
E7	IT/PATTERN RECOGNITION RESEARCH VEHICLE	1			E7
E8	IT/PATTERN RECOGNITION SCHEME	1			E8
E9	IT/PATTERNS	1		7	E9

ENTER NEXT COMMAND

(The closest match to user phrase is preceded by an asterisk(\*). Alpha siblings of the user phrase are also displayed.)

S-E5 1 113 IT/PATTERN RECOGNITION

(E5 was selected for temporary storage.)

E-IT/CHARACTER RECO

(Search thesaurus for alpha siblings of CHARACTER RECO.)

REF	DESCRIPTOR	CITATIONS	REL.	TERMS	REF
E1	IT/CERVIX	1			E1
E2	IT/CHAINING	1			E2
E3	IT/CHANNEL	12			E3
E4	IT/CHARACTER	2		10	E4
E5	*IT/CHARACTER RECOGNITION	34		5	E5
E6	IT/CHARACTER RECOGNITION EQUIPMENT	5		1	E6
E7	IT/CHARACTER RECOGNITION HARDWARE	2			E7
E8	IT/CHARACTERISTIC	18			E8
E9	IT/CHARACTERISTICS	2		9	E9

ENTER NEXT COMMAND

(Results of search.)

	Statement No.	
S-E5	2	34 IT/CHARACTER RECOGNITION
S-"10		INVALID REQUEST. PLEASE CHECK AND RE-ENTER.
S-E10	3	4 IT/AUTOMATIC CHARACTER RECOGNITION EQUIPMENT
S-E11	4	5 IT/CHARACTER RECOGNITION EQUIPMENT
S-E12	5	2 IT/CHARACTER RECOGNITION HARDWARE
S-E13	6	1 IT/OPTICAL CHARACTER RECOGNITION
S-E14	7	1 IT/SCRIPT CHARACTER RECOGNITION
C-2-6/+	8	36 2+3+4+5+6
C-1+8	9	10 1+(2+3+4+5+6)
E-GL/ROME AIR		
S-E6	10	13 ROME AIR DEVELOPMENT CENTER
S-E7	11	1 GL/ROME AIR DEVELOPMENT CENTEREMIA
C-10+11	12	14 10+11
C-9+12	13	2 1+(2+3+4+5+6)+(10+11)
D-13		

DISPLAY 13/2/1

67A11313 AC/DF575631 11-65 64415064 5591 02 003 CC/2B SC/009400

TI/IMPLEMENTATION OF DOCUMENT FORMAT RECOGNITION (TU/COMPUTERS AFSC,USAF,DDR /E)

RI/GREENLY, JAMES F. (315833082600) IN/GRAY, S. (617A89488444) IN/BLITZ, M. (617389488444)

CN/AF30A602603902 CT/A CA/000092309 PH/B

GL/ROME AIR DEVELOPMENT CENTER GRIFFISS AFB, N. Y. 13442

PO/SYLVANIA ELECTRONIC SYSTEMS WALTHAM, MASS. OT/UN IC/339285

LC/22

FU/65-85 FU/66-7

ENTER NEXT COMMAND(1

(Statement no's. 8-9-12-13 are examples of the Boolean combination of previously defined statements. D-13 is a display of the results of statement no. 13.)

## APPENDIX I

### THE FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY AND THE COMMITTEE ON SCIENTIFIC AND TECHNICAL INFORMATION (COSATI)

The functions of the Federal Council for Science and Technology are prescribed in Section 2 of Executive Order 10807.

- "a. The Council shall consider problems and developments in the fields of science and technology and related activities affecting more than one Federal agency or concerning the overall advancement of the Nation's science and technology, and shall recommend policies and other measures
- (1) to provide more effective planning and administration of Federal scientific and technological programs,
  - (2) to identify research needs including areas of research requiring additional emphasis,
  - (3) to achieve more effective utilization of the scientific and technological resources and facilities of Federal agencies, including the elimination of unnecessary duplication, and
  - (4) to further international cooperation in science and technology. In developing such policies and measures the Council, after consulting, when considered appropriate by the Chairman, the National Academy of Sciences, the President's Science Advisory Committee, and other organizations, shall consider
    - (i) the effects of Federal research and development policies and programs on non-Federal programs and institutions,
    - (ii) long-range program plans designed to meet the scientific and technological needs of the Federal Government, including manpower and capital requirements, and
    - (iii) the effects of non-Federal programs in science and technology upon Federal research and development policies and programs.

- b. The Council shall consider and recommend measures for the effective implementation of Federal policies concerning the administration and conduct of Federal programs in science and technology.
- c. The Council shall perform such other related duties as shall be assigned, consonant with law, by the President or by the Chairman.
- d. The Chairman shall, from time to time, submit to the President such of the Council's recommendations or reports as require the attention of the President by reasons of their importance or character. "

The Council has formed several working groups or committees. Each committee focuses on one area of problems. As problems are resolved, proven insoluble or subdivided, existing committees are disbanded and new ones established as needed.

In 1962, the Committee on Scientific Information (COSI) was formed as a working group of the Council. Two years later, its successor, the Committee on Scientific and Technical Information (COSATI), was created.

COSATI objectives and activities include:

- developing guidelines for improving national and federal systems for handling scientific and technical information
- promoting federal inter-agency cooperation and coordination in the development of decentralized information systems for technical professionals
- reviewing and reporting on the adequacy of state-of-the-art scientific and technical information programs
- developing government standards for the international exchange of scientific and technical information.

In order to focus attention on work being done in the field of information sciences technology by the federal agencies, the Department of Defense sponsored the creation in June 1965 of COSATI

Panel 2. To date, the panel has generated the following outputs to COSATI:

- a long-range plan for developing and using information sciences technology in government
- a methodology for long-range planning (1966)
- COSATI Inventory I (1966)
- COSATI Inventory II (1967)



# APPENDIX II

COSATI IST INVENTORY REVIEW REPORT				PAGE 2018 OCT 10, 1967
DEPARTMENT OF INTERIOR				
I INFORMATION STORAGE AND RETRIEVAL				
C -- INFORMATION AND/OR MANAGEMENT SYSTEMS STUDIES				
TITLE: (U) A STUDY ANALYSIS OF THE DEMAND FOR OUTDOOR RECREATION BASED ON THE NATL. RECREATION SURVEYS OF 1960 AND 1965				
AGENCY ID NO.	DATE OF REPORT	DATE STARTED	EST. COMPL. DATE	KIND OF REPORT
1 000003	30 MAR 67	DEC 66	OCT 68	NEW
ESTIMATED RESOURCES		TYPE PROCUREMENT	CONTRACT/GRANT NO.	
FY	MAN	FUNDS	CONTRACT	7-14-07-4
FY	YEARS	(IN THOUSANDS)		
66				
67	2.0	26		
68	2.5	31		
COSATI SUBJECT CATEGORY LIST: 015400 SOCIOLOGY				
PERFORMING ORGANIZATION		RESPONSIBLE GOVERNMENT LABORATORY		
RUTGERS - THE STATE UNIV., BUREAU OF ECONOMIC RESEARCH ; NEW BRUNSWICK, N. J.		DEPT. OF INTERIOR, OUTDOOR RECREATION BUR. WASHINGTON, D. C. 20240		
PRINCIPAL INVESTIGATOR		RESPONSIBLE INDIVIDUAL		
DAVIDSON, P		KINTER, L S		
TELEPHONE: 202 247-1766		TELEPHONE: 202 343-5611		
ASSOCIATE INVESTIGATOR				
CICCHETTI C.				
TELEPHONE: 202 343-5661				
DESCRIPTORS: (U) TEST METHODS; (U) RECREATION; (U) ANALYSIS; (U) PREDICTIONS; (U) ECONOMICS; (U) ADVANCED PLANNING; (U) STATISTICAL ANALYSIS; (U) MATHEMATICAL MODELS.				
IDENTIFIERS: (U) IST.				
KEYWORDS: (U) MULTIPLE REGRESSION; (U) COMPUTER PROGRAMMING; (U) ECONOMETRIC ANALYSIS; (U) PARTICIPATION PREDICTIONS.				
SUMMARY: (U) OBJECTIVE TO DEVELOP A SUPPLY-DEMAND PREDICTION MODEL FOR EACH OF 25 OUTDOOR RECREATION ACTIVITIES FOR PROJECTING AREA AND FACILITY NEEDS TO 1980 - 2000. APPROACH DEVELOPMENT OF MODELS OF OUTDOOR RECREATION SUPPLY-DEMAND CHARACTERISTICS FOR INDIVIDUAL ACTIVITIES IN ORDER TO IDENTIFY SIGNIFICANT VARIABLES ASSOCIATED WITH PARTICIPATION BEHAVIOR IS A PRELIMINARY STEP. THIS WILL BE FOLLOWED BY AN ECONOMETRIC ANALYSIS OF THE INTERRELATIONSHIPS OF PREFERENCES TRIP CHARACTERISTICS AND PARTICIPATION TO DEVELOP ACCURATE PARTICIPATION PREDICTIONS FOR EACH ACTIVITY.				
PROGRESS: (U) A THEORETICAL ECONOMETRIC MODEL HAS BEEN BUILT AND IS BEING TESTED.				

COSATI IST INVENTORY FORM

APPENDIX III  
ON-LINE QUERY FORMULATION

Question 1 - Find all instances where keyword is time-sharing.

CCA

1. FIND ALL ITEMS FOR WHICH  
KEYWORD = TIME-SHARING
2. COUNT ITEMS IN 1
3. PRINT COUNT IN 2

LOCKHEED

SELECT *	IT/TIME SHARING	1
	IT/TIME-SHARING	2
	IT/TIME & SHARING	3
	IT/TIME-SHARED COMPUTERS	4
COMBINE *	1-4/+	5

NOTE: From examination of indexing vocabulary through the EXPAND command, it can be seen that the following variations exist:

<u>TYPE OF SUBJECT TERM</u>	<u>FORM</u>	<u>NUMBER OF ITEMS</u>
KEYWORD	TIME-SHARING	1
	TIME & SHARING	1
	TIME-SHARED COMPUTERS	3
SUBJECT HEADING	TIME-SHARING	12
DESCRIPTOR	TIME-SHARING	3

\* Denotes Special Purpose Key - See Appendix IV

Question 2 - Print out titles for all hits of (1).

CCA

4. FOR EACH ITEM IN 1  
PRINT TITLE

LOCKHEED

PRINT \*

5

Question 3 - Print out all information in the data base for each item in (1).

CCA

5. FOR EACH ITEM IN 1  
PRINT ALL INFORMATION

LOCKHEED

TYPE 5

---

\* Denotes Special Purpose Key - See Appendix IV

Question 4 - Find all instances where Date of Report is between  
March 1967 - June 1967.

CCA

1. FIND ALL ITEMS FOR WHICH  
REPORT MONTH = MARCH OR  
APRIL - OR MAY OR JUNE  
REPORT YEAR = 67
2. COUNT ITEMS IN 1
3. PRINT COUNT IN 2

APPENDIX IV  
DIALOG II

FUNCTION KEYS

THE LOCKHEED SYSTEM PREEMPTS THE USE OF  
THE UPPER-CASE NUMBERS AS SHOWN BELOW.

BEGIN SEARCH	EXPAND TERM	SELECT TERM	COMBINE SET DESCRIP- TION	LIMIT SET/YR/ TYPE/ RANGE	KEEP SET ITEM		DISPLAY SET/FMT ITEM	TYPE SET/ FMT/ ITEM	PRINT SET/ FMT/ ITEM	END SEARCH	
\$ 1	@ 2	< 3	> 4	% 5	+6	7	* 8	( 9	) 0	- -	BKSP

APPENDIX V  
FEATURES OF EACH SYSTEM

SDC - LUCID QUUP (Teletype)

1. Operational time sharing system. Computer is a Q-32.
2. Automatic assignment of synonyms - user may use synonyms in place of longer alpha-terms.
3. System acknowledges all input as soon as received by typing out 4 dashes.
4. On-line file maintenance is possible - allows user to immediately correct any errors he detects in his data base.
5. Min, max, ranging, sum, and average are available functions.
6. Can operate in priority or non-priority mode.

DATA CORPORATION - DATA CENTRAL (1050 Console Dataphone)

1. All fields and text are searchable.
2. When generating a data base the user has a choice of mapping connectors into other connectors, e. g., -, /, \*, would be all changed to blanks.
3. User specifies a list of fields to be printed and the sorting order.
4. Phrase order of search terms is preserved in retrieval, i. e., time shared does not become shared time.
5. User may designate either off-line printout or on-line printout of retrieved information.

COMPUTER CORPORATION OF AMERICA - 103 (2260 CRT)

1. Query composition may take as many lines as necessary - the user may space input to his own convenience - each line is accepted as part of the same query until either END is entered or a new statement number is entered.

2. A backlog of 12 sequential screens or pages of current input is maintained. The user may reference any one of the previous 12 screens for his information.
3. The user may peruse documents in "hurry mode." This means screens-full of documents flip past the user, in sequence.
4. On-line printout of all transactions during a given run may be requested by the user from the console.
5. Special features include counts of number of hits and shorthand for standard queries, e.g., FD = FIND ALL ITEMS FOR WHICH.
6. A temporary file of current run's queries is maintained to allow user to reuse or modify a previously formulated query.

LOCKHEED - DIALOG (2260 CRT)

1. Each category of search term has been arranged alphabetically by contents and the number of documents in which the term appears is counted. When the user enters a term and desires related alpha-terms as well as the number of hits for related alpha-terms, EXPAND displays them. The user may choose, by acronym, any term on the screen for further investigation. This is equivalent to a dictionary search.
2. A history of the run activities is maintained on the 1053 printer immediately attached to the CRT. The user thus has hard copy right next to him.
3. A temporary file of current run's queries is maintained to allow the user to reuse or modify a previously formulated query.
4. Delayed printouts of retrieved documents either on-line or off-line are possible.

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UNCLASSIFIED

Security Classification

## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) The MITRE Corporation 1820 Dolley Madison Blvd. McLean, Virginia 22101		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	
		2b. GROUP N/A	
3. REPORT TITLE  A Survey of Five On-Line Retrieval Systems			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) N/A			
5. AUTHOR(S) (First name, middle initial, last name)  Noreen O. Welch			
6. REPORT DATE August 1968		7a. TOTAL NO. OF PAGES 58	7b. NO. OF REFS 16
8a. CONTRACT OR GRANT NO. N/A		9a. ORIGINATOR'S REPORT NUMBER(S) MTP-322	
b. PROJECT NO N/A		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) None	
c.			
d.			
10. DISTRIBUTION STATEMENT  This document has been approved for public release and sale; its distribution is unlimited.			
11. SUPPLEMENTARY NOTES N/A		12. SPONSORING MILITARY ACTIVITY Panel 2 of the Committee on Scientific and Technical Information (COSATI)	
13. ABSTRACT  Panel 2 of the Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology has inventoried government-sponsored work-in-progress in the area of information sciences and technology. This report is a survey of the capabilities of off-the-shelf interactive data handling systems that could be used to access the COSATI inventory on-line. Described in terms of acceptability, effectiveness, performance, and availability, these systems are Data Corporation's Data Central, Computer Corporation of America's 103, Lockheed Research Corporation's DIALOG, and System Development Corporation's LUCID and TDMS.			

DD FORM 1473  
1 NOV 65

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
On-line displays						
On-line query formulation						
Interactive displays						
Interactive query formulation						
Information retrieval system						
COSATI Inventory III						
Data Corporation						
Computer Corporation of America						
Lockheed Research Corporation						
System Research Corporation						
LUCID						
TDMS						
DIALOG						
Data Central						
103						